

Formation Properties Table

Age	Unit Name (Symbol)	Location(s)	Description	Local and Global Significance	Geologic Hazards	Suitability for Development and Recreation	Resource Potential and Protection
QUATERNARY	Alluvial fan deposit (Qf)	Mouth of the Roaring River in Horseshoe Park	Dimensions: 42.3 acres (17 ha), 364,000 yd ³ (278,314 m ³); maximum thickness—44 ft (13 m), average thickness—5.3' (1.6 m); largest boulder—14' × 17.5' × 21' (4m x 5m x 6 m) weighing 452 tons (410 t); sediment ranges from very large boulders to silt	Lawn Lake dam failure on July 15, 1982, deposited fan; very local deposit	Potential for rockfall and flows	Popular recreation area, safety hazard for visitors who climb on rocks	None
	Holzwarth debris flow deposit (Qd)	W side of Kawuneeche Valley (N of Baker Gulch, near Never Summer Ranch)	Lobate mass of mud, sand, and gravel 40 to 100 feet (12 to 30 m) wide; pushed trees to the edge of track and scoured soil (1 ft [0.3 m])	Deposited on June 16, 1978; similar flows occurred between 1969 and 1974 in Baker Gulch; local deposits	Potential for future flows	Surface water flow down the track has produced deep gullies	None
	Valley alluvium (Qa)	Kawuneeche Valley, Moraine Park, North St. Vrain Creek	Gravel, sand, and silt along streams and in alluvial fans along valley margins; also deposits at the margins of lateral moraines (as at Hidden Valley) where moraines dammed streams	Record of climate change (i.e., lake sediments and alluvium of Pinedale and Bull Lake age)	None	Case- by- case, site evaluation necessary for risk of flooding or mass wasting	Sand and gravel deposits may contain groundwater
	Bog deposits (Qo)	East Inlet area, Cache La Poudre headwaters	Organic- rich deposits, probably < 25 ft (8 m) thick	Used to date glacial events; probably late Pinedale or younger in age	None	Unsuitable—wetland	None
	Colluvium (Qc)	Widespread throughout park	Rock debris ranging from silt to boulders; includes talus, solifluction deposits, block fields, and nivation scree (excavation around snow banks); nearly 10 ft (3 m) thick; covers large areas, obscures bedrock	Covers most slopes above tree line	Potential for rockfall and soil movement	Case- by- case, site evaluation necessary for risk of flooding or mass wasting	None
	Landslide deposits (Ql)	Kawuneeche Valley; Jackstraw, Sundance, and Sprague Mountains	Slumps and earth flows of till; large, nearly intact masses of volcanic rocks; jumbled, hummocky masses or relatively intact blocks of Precambrian rocks; slumps of sedimentary rocks and colluvium	Movement varies from none to rapid	Potential for rejuvenated landsliding	Unsuitable—potential for mass wasting	None
	Rock- glacier deposits (Qr)	Abundant—both sides of the Continental Divide and both sides of Never Summer Mountains	Lobate and tongue- shaped masses of rock debris, ranging in size from large blocks to silt; steep fronts; hummocky, commonly furrowed, upper surfaces that slope at relatively low angles; occur at valley heads in alpine environments	Rock glaciers related to three intervals of glaciation	Potential for rockslides	Unsuitable—unstable slopes	None
	Till of neoglaciation (Qh)	Near existing snow and ice masses (e.g., Andrews Glacier)	Fresh to slightly weathered with stony, sandy deposits mainly forming small end moraines near the headwalls of cirques; angular rocks on the surfaces of the end moraines; soil development weak or absent	Deposited by small glaciers that advanced short distances between 120 and 5,000 years ago	Potential for rockslides	Unsuitable—unstable slopes	None
	Till of Pinedale age (Qp)	Moraine and Horseshoe Parks, Wild Basin, Kawuneeche Valley, North Inlet	High (65–100 ft [20–30 m]), sharp- crested moraines; unfilled and undrained kettles. Glaciation began about 30,000 years ago; glacial maximum between 23,000 and 20,000 years ago; deglaciation 15,000 to 12,000 years ago; prior to 10,000 years ago, all Pinedale glaciers disappeared.	Three ages of till—oldest to youngest: pre- Bull Lake, Bull Lake, and Pinedale (no pre- Bull Lake within the park)—distinguished and correlated on the basis of (1) areal and geomorphic position, (2) topographic expression, and (3) degree of weathering	Potential for rockfalls	Suitable for trails—steep slopes	Sand and gravel deposits may contain groundwater
	Till of Bull Lake age (Qb)	Bierstadt Lake, W of Beaver Meadows Entrance, S of Sandbeach Lake, E of Copeland Mountain	More subdued topographic expression than till of Pinedale age; unlike till of Pinedale age, does not dam lakes and rarely contains kettle ponds as a result of infilling by sediment and establishment and incision of spillways. Soil development in Bull Lake till is markedly stronger than in till of Pinedale age. Beginning of Bull Lake glaciation unknown; Bull Lake glaciers present until about 127,000 years ago.		None	Suitable—often stable for development of trails, roads, facilities	Sand and gravel deposits may contain groundwater
TERTIARY	Diamicton (QNd)	Near Meeker Campground	Unsorted, unstratified, unconsolidated, deposit of boulders, cobbles, and pebbles in a silty sand matrix; resembles till, but interpreted as fan deposit of Neogene or Quaternary age	Alluvial origin, not glacial—significant distinction for Cenozoic climatic history and evolution of early drainage	None	N/A—minor deposits	None
	Troublesome Formation (Tt)	E side of Kawuneeche Valley	Gray and orange- gray tuffaceous mudstone and sandstone, volcanic ash beds, and minor clayey limestone and conglomerate; contains several inter- layered basaltic lava flows	Deposited between 23 and 29 Ma	N/A—minor deposits	N/A—minor deposits	Potential fossil mammals
CRETACEOUS DEVONIAN (?)	Extrusive and intrusive igneous rocks	Never Summer Mountains	Eruption of volcanic rocks with intrusion of granite and granodiorite; lavas range from basalt to rhyolite; flows probably issued from volcanic vents in Never Summer Mountains or vicinity of Porphyry Peaks (outside the park). Include rock units: trachyanesite and basalt (Ta), volcanic breccia (Tbr), rhyolite (Tr), rhyolite welded tuff (Trw), volcanic rocks undifferentiated (Tv), rhyolite porphyry and granite of Mt Cumulus stock (Tg), granodiorite monzonite of Mt. Richthofen stock (Tgd), and andesite porphyry (Tap)	Evidence of volcanism between 23 and 29 Ma; volcanic breccia near Lulu Mountain and Seven Utes Mountain and thick welded tuff suggest local caldera source	Rockfall potential in steep terrains above tree line	N/A—remote locations	Obsidian near Specimen Mountain
	Pierre Shale (Kp)	Summits of Mount Cirrus and Howard Mountain	Dark- gray shale underlain by interbedded silty shale and sandstone that grade downward into dark- gray to black marine shale; metamorphosed to a dense brown- green rock characterized by hackly fracture; exposed where pushed up by intrusive igneous rocks in the Never Summer Mountains	Remnant of the Cretaceous Interior Seaway; documents > 11,000 ft (3,353 m) of uplift since about 70 Ma	N/A—minor deposits	N/A—minor deposits	Ammonite fossils well known outside Rocky Mountain National Park
	Kimberlite (Dk)	Hayden Gorge and W of Isolation Peak	Dark- gray to dark- olive- green rock, friable, easily disintegrates; occurs in small dikes; identified by distinctive mineralogy: high biotite content, pyrope garnet, chrome- rich pyroxene, and carbonate cement	Only rock from Earth's mantle in Rocky Mountain National Park; Age: Paleozoic—post- Silurian and pre- Pennsylvanian possibly Devonian	N/A—minor deposits	N/A—minor deposits	Similar intrusions W of Ft. Collins contain trace diamonds; no diamonds have been identified in park deposits

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PRECAMBRIAN	Gabbro of the Iron Dike (Yg)	Hidden Valley, Trail Ridge Road, S face of Mount Chapin, Longs Peak Ranger Station	Distinctive rusty brown color at surface; contains, among other minerals, iron; limonite (brown staining formed by weathering of iron-bearing minerals) occurs at rock joints; probably emplaced by a single, rapid eruption originating in a deep, upward-propagating crack. Dike has been traced 85 miles (120 km) from the small mining town of Magnolia (W of Boulder), past Allenspark, into park, and N into Medicine Bow Mountains.	Iron-rich soil supports distinctive plant communities Age: 1,317 Ma	N/A—narrow dike	N/A—narrow dike	None
	Silver Plume Granite (Ysp)	Lumpy Ridge, McGregor Mountain, Longs Peak, Trail Ridge Road	Medium- to coarse-grained crystalline igneous rock; contains quartz, feldspar, mica, and minor amounts of other minerals; intruded into older biotite schist and gneiss; flowed upward and outward into the biotite schist and gneiss and rotated the older rocks into the flat-lying orientation observed today; crosscuts Ygh	Age: 1,420 Ma	Rockfalls in steep terrain, especially above tree line	Stable bedrock	Building stone
	Granite of Hagues Peak (Ygh)	Hagues Peak, Mummy Mountain, and Stormy Peaks	Tan, coarse-grained to very coarse-grained, porphyritic granite composed of quartz, microcline, oligoclase, and biotite; contains flow-aligned phenocrysts of microcline 1- to 3-in (2.5- to 7.6- cm) long, and scattered, small, partially assimilated inclusions of biotite schist that contain large recrystallized crystals of microcline	Notable for marking an intrusive event (1,480 Ma)	Rockfalls in steep terrain, especially above tree line	Stable bedrock	Large crystals of microcline (feldspar)
	Mafic dikes (Yd)	Near Eagle Cliff, Continental Divide (series of dikes)	Form a northwest-trending swarm of black to light-gray, fine- to medium-grained metabasalt or meta-andesite; very minor unit	Older than Ysp (> 1,430 Ma) but younger than Ygh	Rockfalls in steep terrain, especially above tree line	Part of stable bedrock	None
	Pegmatite (YXp)	Rock Cut, spires at Poudre Lake-Milner Pass	Coarse-grained igneous rocks with interlocking crystals of quartz, feldspar, and mica in dikes, lenses, or veins; both older and younger pegmatites (related to Xbc and Ysp) present in the park but not easily distinguished	Contemporaneous with Xbc or Ysp	Rockfalls in steep terrain, especially above tree line	Part of stable bedrock	Specimens of biotite, quartz, feldspar, tourmaline, garnet
	Boulder Creek Granodiorite (Xbc)	Paradise Park, Adams Lake, Lake Verna	Similar to granite but darker gray and less commonly pink; contains more biotite and commonly shows banded, streaky fabric	Intruded about same time as regional metamorphism (1,664 Ma)	Rockfalls in steep terrain, especially above tree line	Stable bedrock	Large crystals of microcline (feldspar)
	Biotite schist and biotite gneiss (Xs)	Chasm Lake-Mount Meeker, Hallett Peak, Ypsilon Mt., Eagle Cliff, Loch Vale, East Inlet	Banded metamorphic rocks marked by alternating layers containing more or less biotite	Oldest rocks in park (1,700 Ma) and some of the oldest in the National Park System; Jackstraw Mountain landslide deposit	Rockfalls in steep terrain, especially above tree line	Suitable—with caution on steep slopes	Building stone